

DOCKET NO.: ISIS-1158

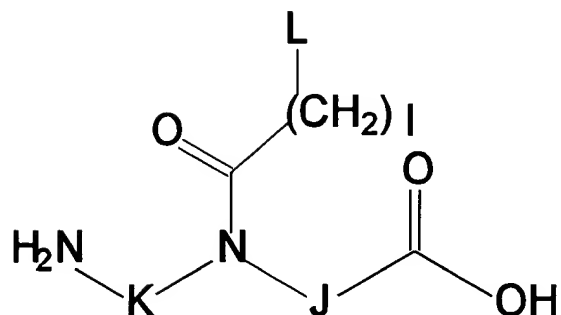
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 1634

Please amend claims 30 and 38 as indicated below:

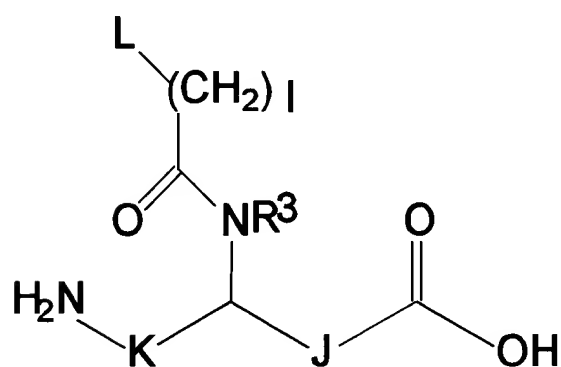
30. (Twice amended) A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:

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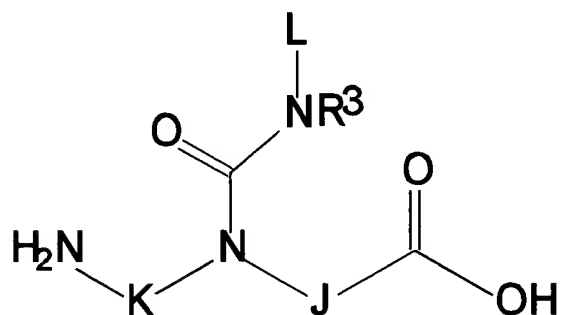
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 1634



or formula:



or formula:



wherein:

L is $R^{12}(R^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

K is $(CR^6R^7)_z$;

J is $(CR^6R^7)_y$; wherein:

R^6 and R^7 are independently hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino;

R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-,
alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

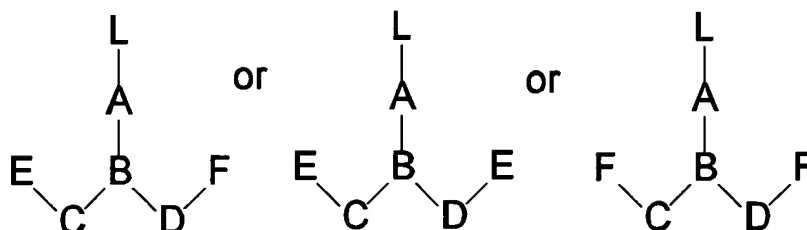
each of y and z is zero or an integer from 1 to 10, the sum
y + z being greater than 2 but not more than 10;

l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from
a reporter enzyme, a reporter molecule, a steroid, a carbo-
hydrate, a terpene, a peptide, a protein, a phospholipid, a cell
receptor binding molecule, a crosslinking agent, a water soluble
vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a
metal chelator, a porphyrin, an alkylator, or a polymeric
compound selected from polymeric amines, polymeric glycols and
polyethers; [and compare]

wherein said conjugate optionally includes a linking moiety.

38. (Amended) A compound having one of the following formulas:



wherein:

L is $\text{R}^{12}(\text{R}^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, $(\text{C}_1\text{-C}_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

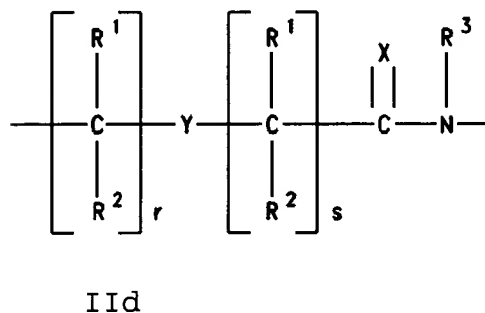
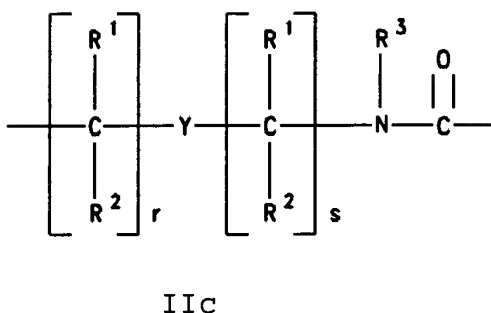
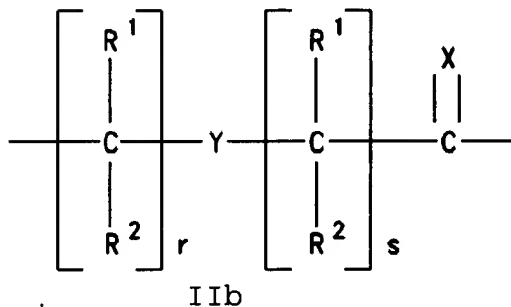
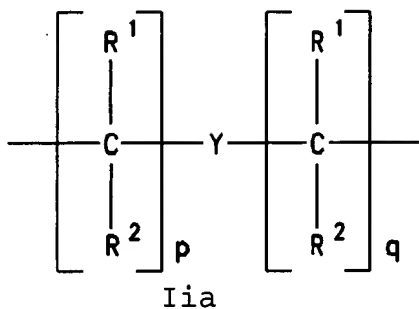
R^{13} is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or R^3N^+ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se, NR³, CH₂ or C(CH₃)₂;

Y is a single bond, O, S or NR⁴;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R¹ and R² independently are hydrogen, (C₁-C₄)alkyl, hydroxy-substituted (C₁-C₄)alkyl, alkoxy-substituted (C₁-C₄)alkyl, alkylthio-substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR⁶R⁷)_y;

D is (CR⁶R⁷)_z; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino; and R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum $y + z$ being greater than 2 but not more than 10;

E independently is $COOH$, $CSOH$, $SOOH$, SO_2OH or an activated or protected derivative thereof;

F independently is NHR^3 or $NPgR^3$, where Pg is an amino protecting group;

[wherein:] or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

Please add new claims 39-49 as indicated below:

$$\left[\begin{array}{c} \text{L}_m \\ | \\ \text{A}_m \\ | \\ \text{B}_m \\ / \quad \backslash \\ \text{C}_m \quad \text{D}_m \end{array} \right]_m \quad \begin{array}{c} \text{L} \\ | \\ \text{A} \\ | \\ \text{B} \\ / \quad \backslash \\ \text{C} \quad \text{D} \end{array}$$

L and L_m independently are $R^{12}(R^{13})_a$ wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

C and C_m independently are $(CR^6R^7)_y$; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 , SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

wherein R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl; and

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-

substituted (C₁-C₄)alkyl, hydroxy, alkoxy,
alkylthio or amino;

D and D_m independently are (CR⁶R⁷)_z;

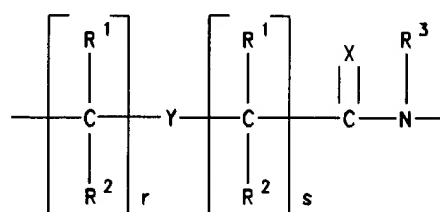
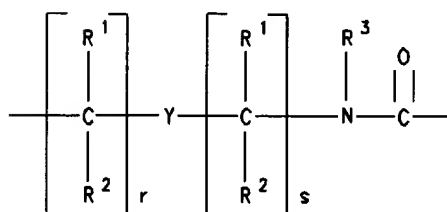
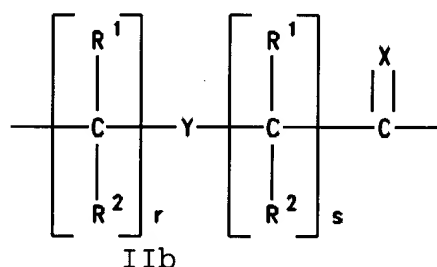
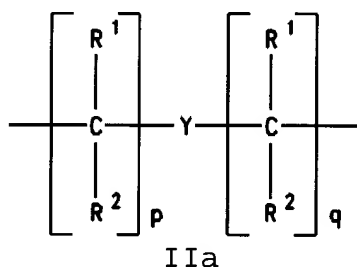
each of y and z is zero or an integer from 1 to 10, wherein
the sum y + z is greater than 2 but not more than 10;

G_m is independently -NR³CO-, -NR³CS-, -NR³SO-, or
-NR³SO₂- in either orientation;

each pair of A-A_m and B-B_m are selected such that:

(a) A or A_m is a group of formula (IIa), (IIb) or (IIc) and
B or B_m is N or R³N⁺; or

(b) A or A_m is a group of formula (IIId) and B or B_m is CH;



wherein:

X is O, S, Se, NR³, CH₂ or C(CH₃)₂;

Y is a single bond, O, S or NR^4 ;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R^1 and R^2 independently are hydrogen, $(\text{C}_1\text{-C}_4)\text{alkyl}$, hydroxy-substituted $(\text{C}_1\text{-C}_4)\text{alkyl}$, alkoxy-substituted $(\text{C}_1\text{-C}_4)\text{alkyl}$, alkylthio-substituted $(\text{C}_1\text{-C}_4)\text{alkyl}$, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is $-\text{NR}^8\text{R}^9$ or $-\text{NR}^{10}\text{C}(\text{O})\text{R}^{11}$; wherein:

R^8 , R^9 , R^{10} and R^{11} independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

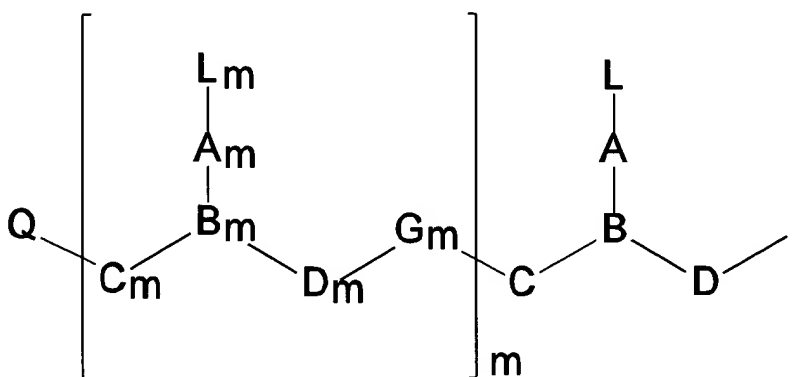
Q is $-\text{CO}_2\text{H}$, $-\text{CO}_2\text{R}^8$, $-\text{CO}_2\text{R}^9$, $-\text{CONR}^8\text{R}^9$, $-\text{SO}_3\text{H}$, $-\text{SO}_2\text{NR}^{10}\text{R}^{11}$ or an activated derivative of $-\text{CO}_2\text{H}$ or $-\text{SO}_3\text{H}$; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

wherein said conjugate optionally includes a linking moiety;
and

40. A peptide nucleic acid conjugate of the formula:



m is an integer from 1 to about 50;

L and L_m independently are $R^{12}(R^{13})_a$ wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

C and C_m independently are $(CR^6R^7)_y$; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 , SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

wherein R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl; and

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-

substituted (C₁-C₄)alkyl, hydroxy, alkoxy,
alkylthio or amino;

D and D_m independently are (CR⁶R⁷)_z;

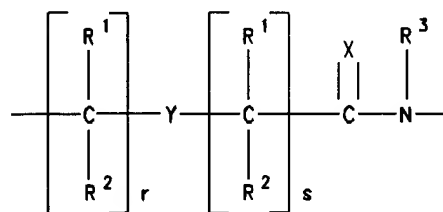
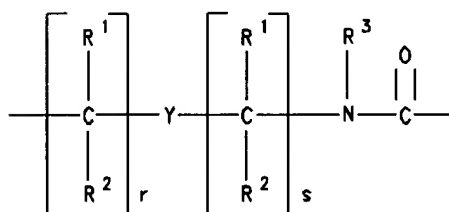
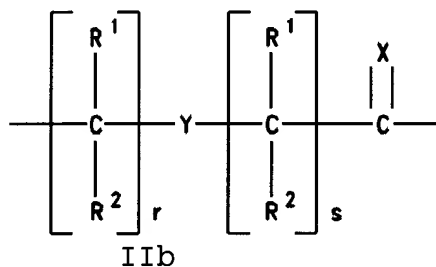
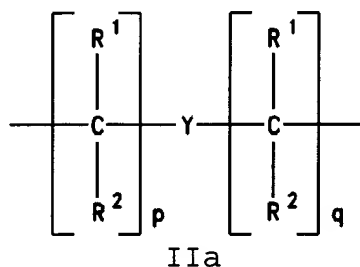
each of y and z is zero or an integer from 1 to 10, wherein
the sum y + z is greater than 2 but not more than 10;

G_m is independently -NR³CO-, -NR³CS-, -NR³SO-, or
-NR³SO₂- in either orientation;

each pair of A-A_m and B-B_m are selected such that:

(a) A or A_m is a group of formula (IIa), (IIb) or (IIc) and
B or B_m is N or R³N⁺; or

(b) A or A_m is a group of formula (IIId) and B or B_m is CH;



wherein:

X is O, S, Se, NR³, CH₂ or C(CH₃)₂;

Y is a single bond, O, S or NR^4 ;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R^1 and R^2 independently are hydrogen, $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkoxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkylthio-substituted $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is $-\text{NR}^8\text{R}^9$ or $-\text{NR}^{10}\text{C}(\text{O})\text{R}^{11}$; wherein:

R^8 , R^9 , R^{10} and R^{11} independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is $-\text{CO}_2\text{H}$, $-\text{CO}_2\text{R}^8$, $-\text{CO}_2\text{R}^9$, $-\text{CONR}^8\text{R}^9$, $-\text{SO}_3\text{H}$, $-\text{SO}_2\text{NR}^{10}\text{R}^{11}$ or an activated derivative of $-\text{CO}_2\text{H}$ or $-\text{SO}_3\text{H}$; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

wherein at least one of R^8 , R^9 , R^{10} and R^{11} is a conjugate.

The diagram shows a chemical structure of a polycondensate. It consists of two cyclohexane rings connected by a methylene bridge (labeled 'm'). The left cyclohexane ring is substituted with a quaternary carbon (Q) and a methylene group (Cm) on one side, and a methylene group (Dm) and a methylene group (Gm) on the other. The right cyclohexane ring is substituted with a quaternary carbon (L) and a methylene group (A) on one side, and a methylene group (B) and a methylene group (D) on the other.

L and L_m independently are $R^{12}(R^{13})_a$ wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

C and C_m independently are $(CR^6R^7)_y$; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 , SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

wherein R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl; and

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-

substituted (C₁-C₄)alkyl, hydroxy, alkoxy,

alkylthio or amino;

D and D_m independently are (CR⁶R⁷)_z;

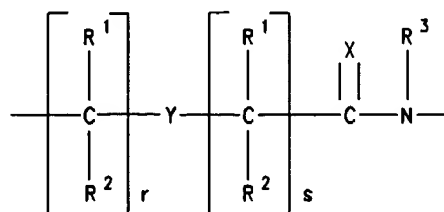
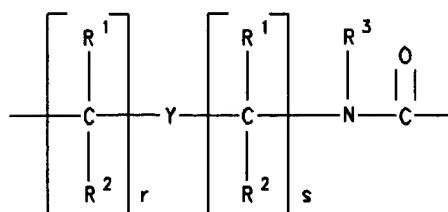
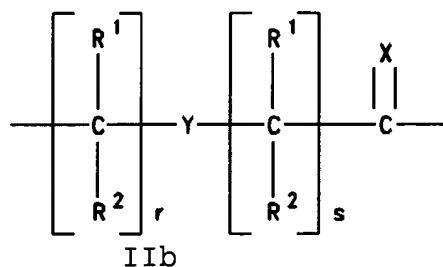
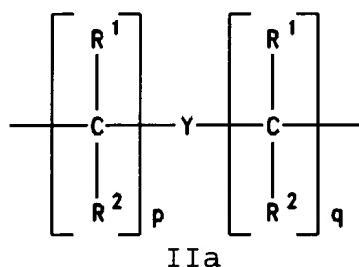
each of y and z is zero or an integer from 1 to 10, wherein the sum y + z is greater than 2 but not more than 10;

G_m is independently -NR³CO-, -NR³CS-, -NR³SO-, or -NR³SO₂- in either orientation;

each pair of A-A_m and B-B_m are selected such that:

(a) A or A_m is a group of formula (IIa), (IIb) or (IIc) and B or B_m is N or R³N⁺; or

(b) A or A_m is a group of formula (IIId) and B or B_m is CH;



wherein:

X is O, S, Se, NR³, CH₂ or C(CH₃)₂;

Y is a single bond, O, S or NR^4 ;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R^1 and R^2 independently are hydrogen, $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkoxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkylthio-substituted $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is $\text{-NR}^8\text{R}^9$ or $\text{-NR}^{10}\text{C}(\text{O})\text{R}^{11}$; wherein:

R^8 , R^9 , R^{10} and R^{11} independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is $\text{-CO}_2\text{H}$, $\text{-CO}_2\text{R}^8$, $\text{-CO}_2\text{R}^9$, $\text{-CONR}^8\text{R}^9$, $\text{-SO}_3\text{H}$, $\text{-SO}_2\text{NR}^{10}\text{R}^{11}$ or an activated derivative of $\text{-CO}_2\text{H}$ or $\text{-SO}_3\text{H}$; and

wherein:

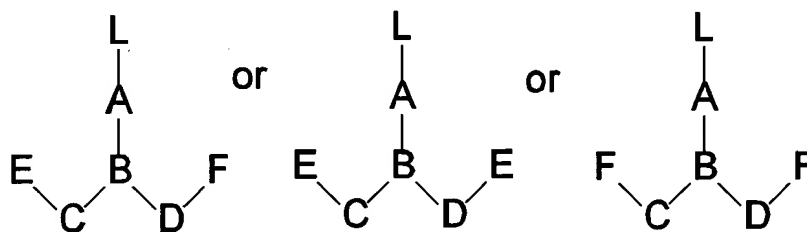
at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A_m, L, and L_m comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of R³ R⁴, R⁵, R⁶ and R⁷ is a conjugate.

42. A peptide nucleic acid conjugate of formula:



wherein:

L is R¹²(R¹³)_a; wherein:

R¹² is hydrogen, hydroxy, (C₁-C₄)alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a

nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

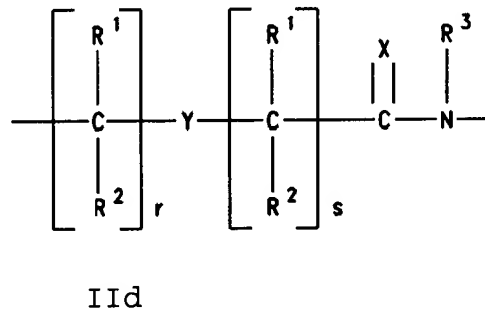
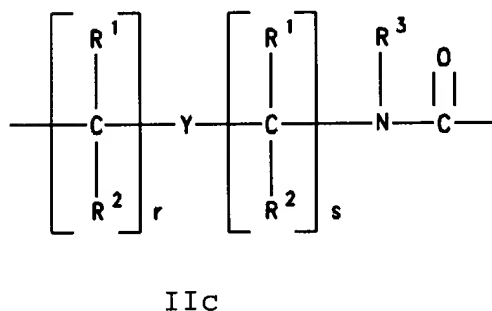
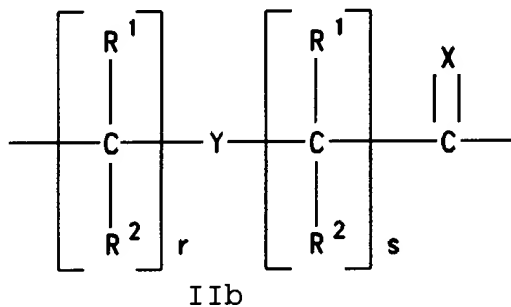
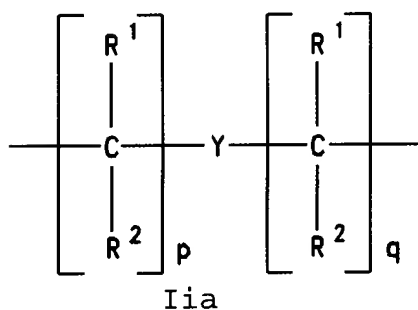
R^{13} is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or R^3N^+ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se, NR^3 , CH_2 or $\text{C}(\text{CH}_3)_2$;

Y is a single bond, O, S or NR^4 ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R^1 and R^2 independently are hydrogen, $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkoxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkylthio-substituted $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is $(\text{CR}^6\text{R}^7)_y$;

D is $(\text{CR}^6\text{R}^7)_z$; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, $(\text{C}_2\text{-C}_6)$ alkyl, aryl, aralkyl, heteroaryl, hydroxy, $(\text{C}_1\text{-C}_6)$ alkoxy, $(\text{C}_1\text{-C}_6)$ alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino; and R^5 is hydrogen, a conjugate, $(\text{C}_1\text{-C}_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted $(\text{C}_1\text{-C}_6)$ alkyl;

each of y and z is zero or an integer from 1 to 10, the sum $y + z$ being greater than 2 but not more than 10;

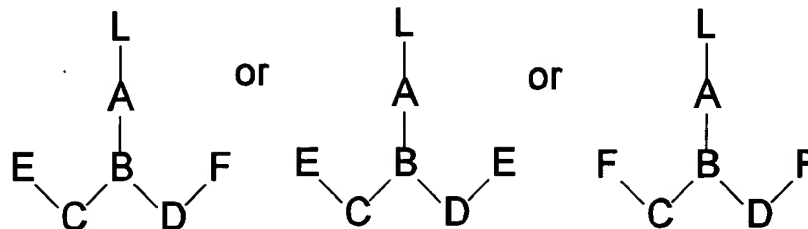
E independently is COOH, CSOH, SOOH, SO₂OH or an activated or protected derivative thereof;

F independently is NHR³ or NPgR³, where Pg is an amino protecting group; or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and
wherein at least one group R³ is a conjugate.

43. A peptide nucleic acid conjugate of formula:



wherein:

L is $\text{R}^{12}(\text{R}^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, $(\text{C}_1\text{-C}_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

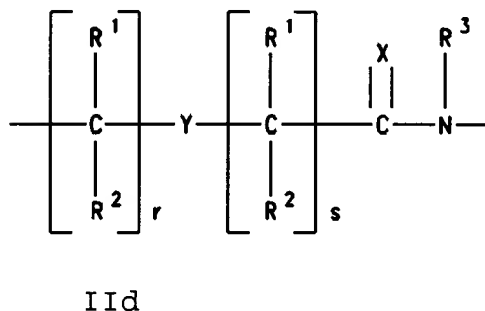
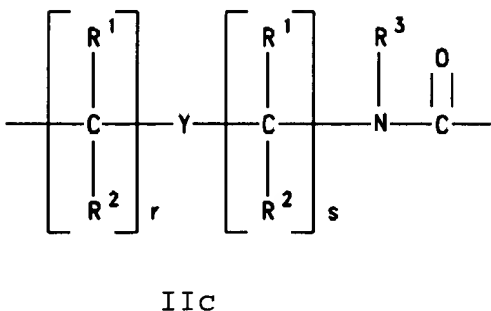
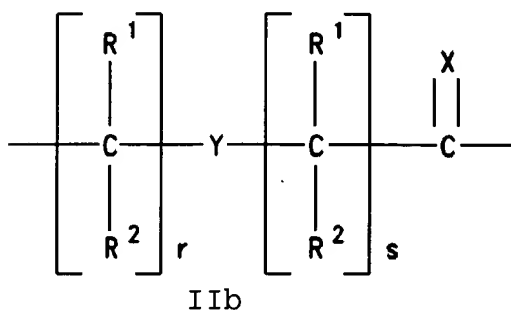
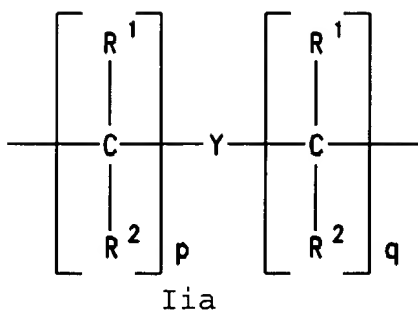
R^{13} is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or R^3N^+ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se, NR³, CH₂ or C(CH₃)₂;

Y is a single bond, O, S or NR⁴;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R¹ and R² independently are hydrogen, (C₁-C₄)alkyl, hydroxy-substituted (C₁-C₄)alkyl, alkoxy-substituted (C₁-C₄)alkyl, alkylthio-substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR⁶R⁷)_y;

D is (CR⁶R⁷)_z; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino; and R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum $y + z$ being greater than 2 but not more than 10;

E independently is $COOH$, $CSOH$, $SOOH$, SO_2OH or an activated or protected derivative thereof;

F independently is NHR^3 or $NPgR^3$, where Pg is an amino protecting group; or

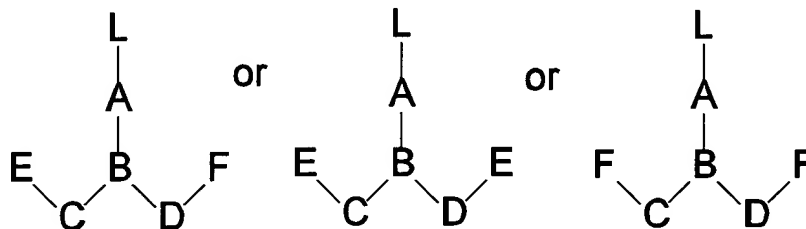
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a

carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of said groups A or said groups B include a conjugate.

44. A peptide nucleic acid conjugate of formula:



wherein:

L is $R^{12}(R^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a

reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

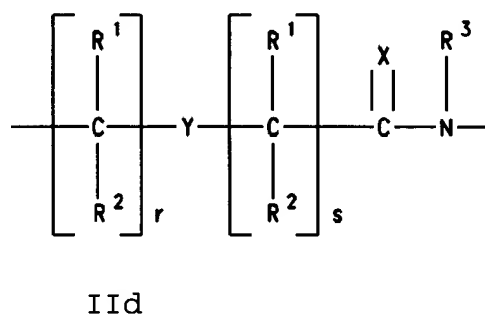
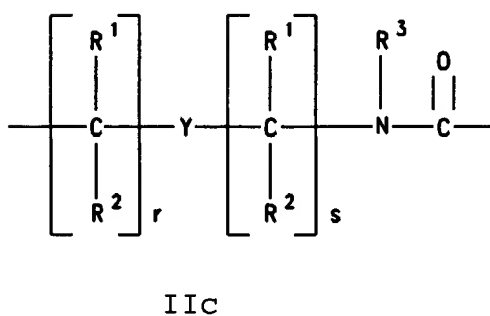
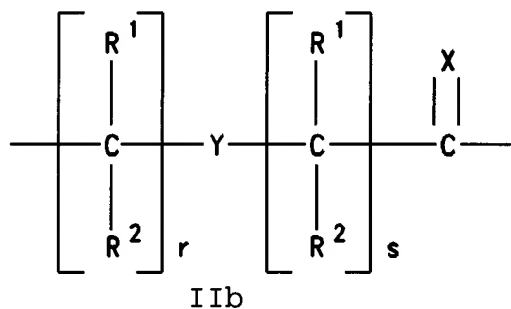
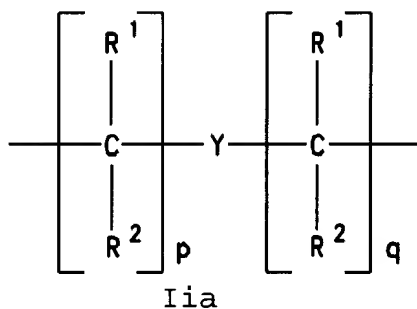
R^{13} is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or R^3N^+ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se, NR^3 , CH_2 or $C(CH_3)_2$;

Y is a single bond, O, S or NR^4 ;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R^1 and R^2 independently are hydrogen, $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkoxy-substituted $(\text{C}_1\text{-C}_4)$ alkyl, alkylthio-substituted $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is $(\text{CR}^6\text{R}^7)_y$;

D is $(\text{CR}^6\text{R}^7)_z$; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, $(\text{C}_2\text{-C}_6)$ alkyl, aryl, aralkyl, heteroaryl, hydroxy, $(\text{C}_1\text{-C}_6)$ alkoxy, $(\text{C}_1\text{-C}_6)$ alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy- or alkoxy- or alkylthio-substituted $(\text{C}_1\text{-C}_4)$ alkyl, hydroxy, alkoxy, alkylthio or amino; and R^5 is hydrogen, a conjugate, $(\text{C}_1\text{-C}_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted $(\text{C}_1\text{-C}_6)$ alkyl;

each of y and z is zero or an integer from 1 to 10, the sum $y + z$ being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO₂OH or an activated or protected derivative thereof;

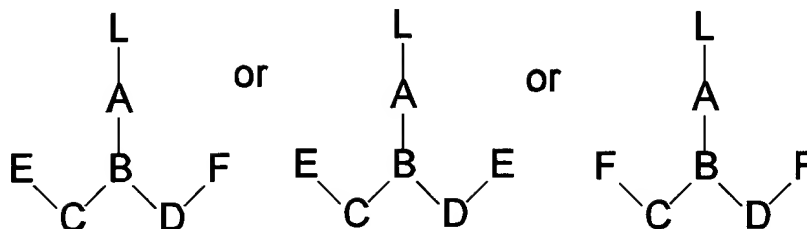
F independently is NHR³ or NPgR³, where Pg is an amino protecting group; or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of group R¹ or group R² is a conjugate.

45. A peptide nucleic acid conjugate of formula:



wherein:

L is $\text{R}^{12}(\text{R}^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, $(\text{C}_1\text{-C}_4)$ alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

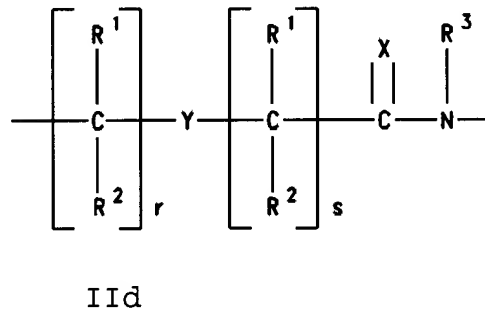
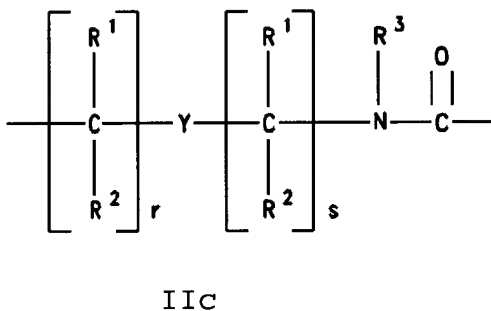
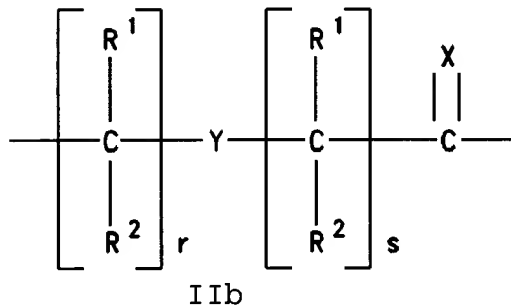
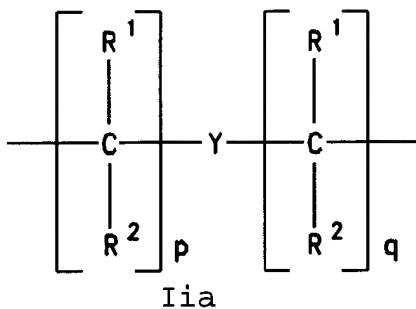
R^{13} is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or R^3N^+ ; or

(b) A is a group of formula (IId) and B is CH;



where:

X is O, S, Se, NR³, CH₂ or C(CH₃)₂;

Y is a single bond, O, S or NR⁴;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R¹ and R² independently are hydrogen, (C₁-C₄)alkyl, hydroxy-substituted (C₁-C₄)alkyl, alkoxy-substituted (C₁-C₄)alkyl, alkylthio-substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR⁶R⁷)_y;

D is (CR⁶R⁷)_z; wherein:

R^6 and R^7 independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino; and R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum $y + z$ being greater than 2 but not more than 10;

E independently is $COOH$, $CSOH$, $SOOH$, SO_2OH or an activated or protected derivative thereof;

F independently is NHR^3 or $NPgR^3$, where Pg is an amino protecting group; or

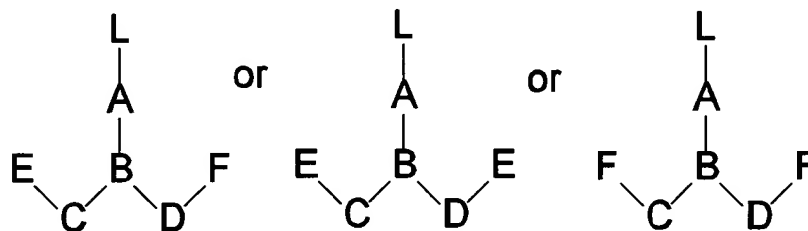
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a

carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of R^3 , R^4 , R^5 , R^6 , and R^7 is a conjugate.

46. A peptide nucleic acid conjugate of formula:



wherein:

L is $R^{12}(R^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12}

is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

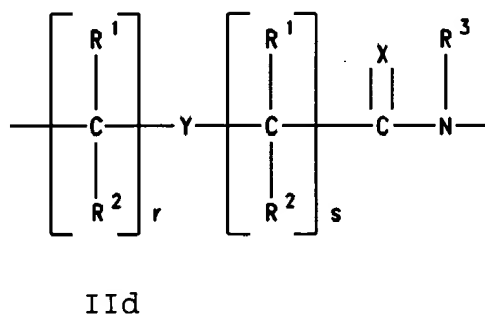
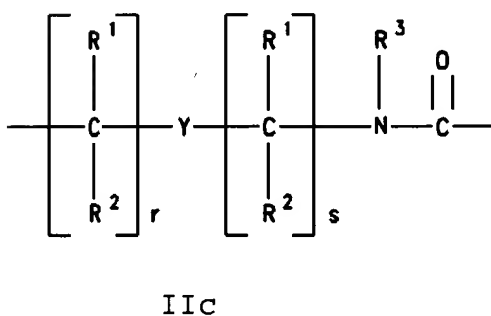
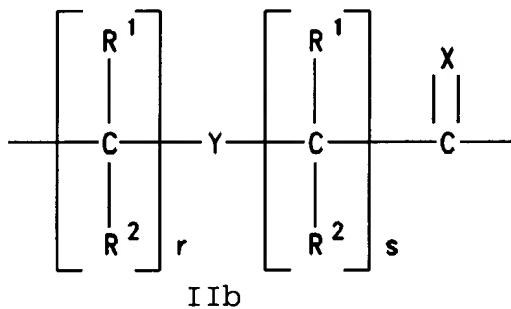
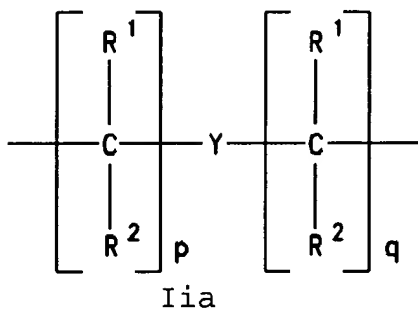
R^{13} is a conjugate; and

a is 0 or 1;

A and B are selected such that:

(a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or R^3N^+ ; or

(b) A is a group of formula (IIId) and B is CH;



where:

X is O, S, Se, NR^3 , CH_2 or $C(CH_3)_2$;

Y is a single bond, O, S or NR^4 ;

p and q independently are zero or an integer from 1 to 5;
r and s independently are zero or an integer from 1 to 5;
R¹ and R² independently are hydrogen, (C₁-C₄)alkyl, hydroxy-substituted (C₁-C₄)alkyl, alkoxy-substituted (C₁-C₄)alkyl, alkylthio-substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR⁶R⁷)_y;

D is (CR⁶R⁷)_z; wherein:

R⁶ and R⁷ independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C₂-C₆) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C₁-C₆) alkoxy, (C₁-C₆) alkylthio, a conjugate, NR³R⁴ and SR⁵ or R⁶ and R⁷ taken together complete an alicyclic or heterocyclic system;

R³ and R⁴ independently are hydrogen, a conjugate, (C₁-C₄)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C₁-C₄)alkyl, hydroxy, alkoxy, alkylthio or amino; and R⁵ is hydrogen, a conjugate, (C₁-C₆)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C₁-C₆)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO₂OH or an activated or protected derivative thereof;

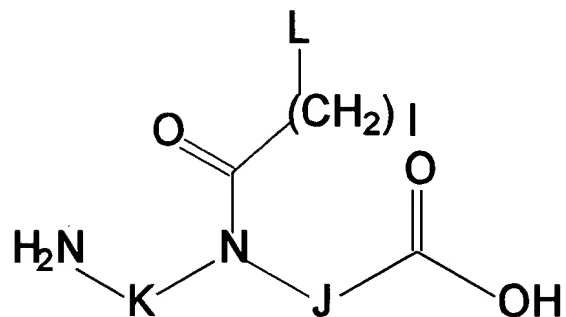
F independently is NHR^3 or NPgR^3 , where Pg is an amino protecting group; or

F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

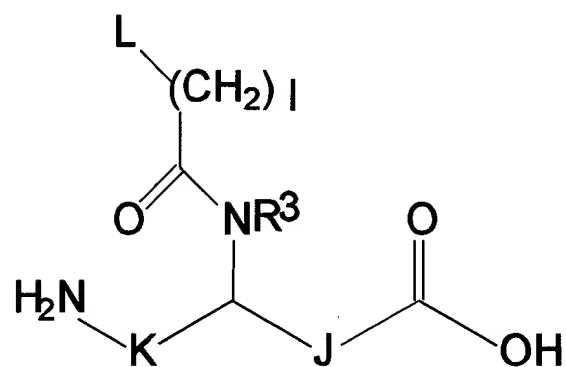
at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of said groups C or said groups D include a conjugate.

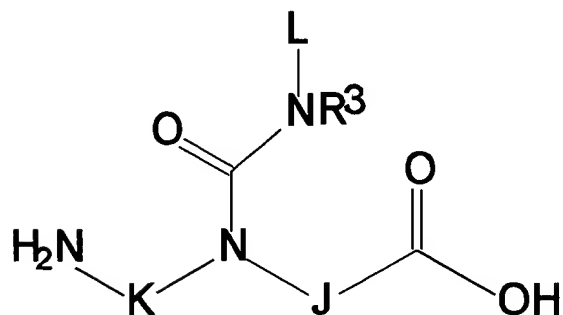
47. A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is $R^{12}(R^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

K is $(CR^6R^7)_z$;

J is $(CR^6R^7)_y$; wherein:

R^6 and R^7 are independently hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino;
 R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum $y + z$ being greater than 2 but not more than 10;

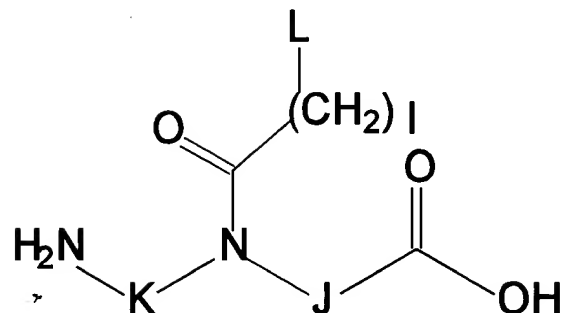
l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

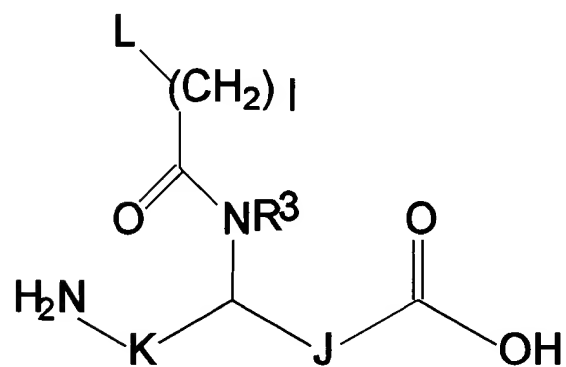
wherein said conjugate optionally includes a linking moiety;
and

wherein at least one of R^3 , R^4 , R^5 , R^6 , and R^7 is a conjugate.

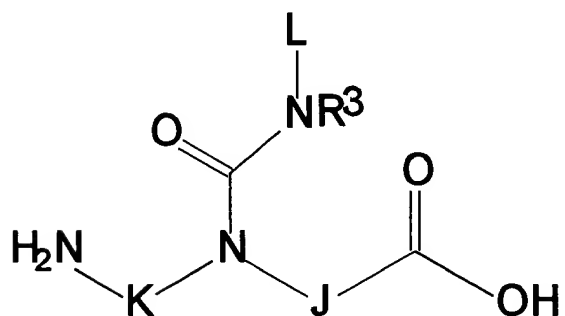
48. A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is $R^{12}(R^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

K is $(CR^6R^7)_z$;

J is $(CR^6R^7)_y$; wherein:

R^6 and R^7 are independently hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino;

R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-,
alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum
y + z being greater than 2 but not more than 10;

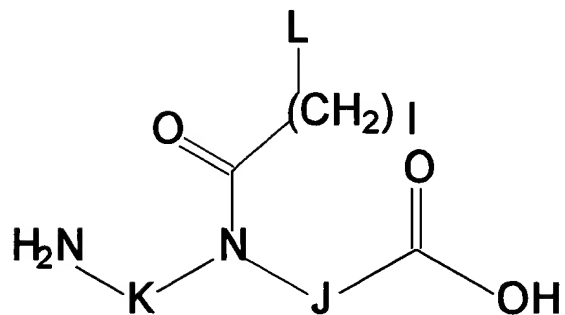
l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from
a reporter enzyme, a reporter molecule, a steroid, a carbo-
hydrate, a terpene, a peptide, a protein, a phospholipid, a cell
receptor binding molecule, a crosslinking agent, a water soluble
vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a
metal chelator, a porphyrin, an alkylator, or a polymeric
compound selected from polymeric amines, polymeric glycols and
polyethers;

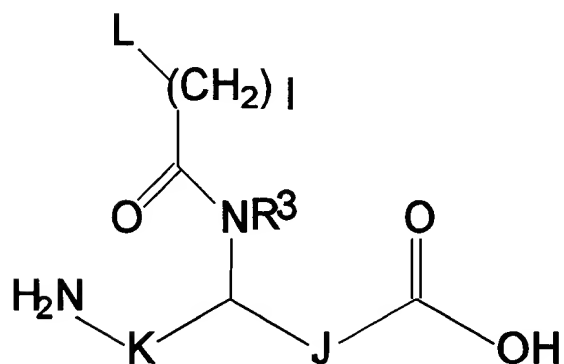
wherein said conjugate optionally includes a linking moiety;
and

wherein at least one of said group K or said group J
includes a conjugate.

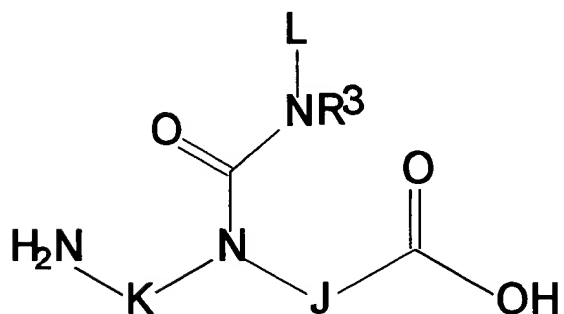
49. A peptide nucleic acid conjugate comprising a plurality
of PNA monomers wherein at least one of said PNA monomers has the
formula:



or formula:



or formula:



wherein:

L is $R^{12}(R^{13})_a$; wherein:

R^{12} is hydrogen, hydroxy, (C_1-C_4) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R^{12} is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R^{13} is a conjugate; and

a is 0 or 1;

K is $(CR^6R^7)_z$;

J is $(CR^6R^7)_y$; wherein:

R^6 and R^7 are independently hydrogen, a side chain of a naturally occurring alpha amino acid, (C_2-C_6) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C_1-C_6) alkoxy, (C_1-C_6) alkylthio, a conjugate, NR^3R^4 and SR^5 or R^6 and R^7 taken together complete an alicyclic or heterocyclic system;

R^3 and R^4 independently are hydrogen, a conjugate, (C_1-C_4) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C_1-C_4) alkyl, hydroxy, alkoxy, alkylthio or amino;

R^5 is hydrogen, a conjugate, (C_1-C_6) alkyl, hydroxy-,
alkoxy-, or alkylthio- substituted (C_1-C_6) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum
y + z being greater than 2 but not more than 10;

l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from
a reporter enzyme, a reporter molecule, a steroid, a carbo-
hydrate, a terpene, a peptide, a protein, a phospholipid, a cell
receptor binding molecule, a crosslinking agent, a water soluble
vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a
metal chelator, a porphyrin, an alkylator, or a polymeric
compound selected from polymeric amines, polymeric glycols and
polyethers;

wherein said conjugate optionally includes a linking moiety;
and

wherein said group R^3 is a conjugate.--

REMARKS

After entry of the proposed amendment, claims 1, 5, 8-10,
12, 13, 15, 18-20, 22-24, 30-33, and 37-49 will be pending in
this patent application.

Applicants have amended the specification to insert the
pages containing a sequence listing to comply with the Sequence